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Modeling of Backward Elimination in Order to Estimate Demand in Rural Areas (Case Study: Qazvin Villages)

Shahriar Afandizadeh ¹, Hamid Bigdeli Rad ^{2*}, Vahid Bigdeli Rad ³, Fatemeh Absari ⁴

¹ Professor, School of Civil Engineering, Iran University of Science and Technology, Tehran, Iran.

² Instructor, School of Civil Engineering, Imam Khomeini University Qazvin, Qazvin, Iran

³ Associate Professor, Department of Urban Planning, Qazvin Branch, Islamic Azad University, Qazvin, Iran

⁴ School of Civil Engineering, Iran University of Science and Technology, Tehran, Iran.

*Correspondence should be addressed to Hamid Bigdeli Rad, Instructor, School of Civil Engineering, Imam Khomeini University Qazvin, Qazvin, Iran Tel: (+98) 21334212731; Email: Hamid.bigdeli29@gmail.com

ABSTRACT

In any transportation planning, including rural transportation, the characteristics of existing supply and demand must be identified. According to this knowledge, the main needs and problems of the villagers in the field of transportation can be identified. In urban transportation planning, travel models are usually built in four stages. In the first stage, travel production and absorption models, in the second stage, travel distribution models, in the third stage, vehicle mode choice models, and in the final stage, route selection and traffic assignment models. In this study, and according to the studies conducted on the difference in behavioral pattern as well as the difference in the way of planning in the village and city, modeling related to the stage of production and absorption of travel is done using backward elimination regression. This study was conducted by case study of a number of villages in Qazvin city and can be generalized to other villages that have similar characteristics. Finally, according to the developed models, it was found that in work trips, the variable of employment rate, in educational trips, the number of students, in shopping trips and ethnics and medicine and in the demand of total travel variable population have the greatest impact on the model. With the current situation demand, it is possible to develop a forecast demand model for different horizons by applying the population growth rate and employment. By estimating the demand for travel, in order to create and build road and rural facilities, road pavement and road maintenance can be planned.

Keywords: Rural Transportation, Demand Estimation, Modeling, Regression, Backward Elimination

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1. INTRODUCTION

Many big city planners have come to the conclusion that the solution to most of the problems is to eliminate immigration to these cities and try to keep the big cities alone [1]. On the other hand, the migration of villagers to cities, the emptying of rural housing units, the loss of past assets such as agricultural lands, aqueducts, water

reservoirs, the underdevelopment of agriculture and animal husbandry, unemployment and addiction of rural youth are the results of this approach. And especially in deprived villages [2,3]. On the other hand, the development of agriculture and animal husbandry is very desirable. Problems and interest in agricultural development have led to a new approach

to developing communities in relation to rural development, with countries such as India and China investing heavily in it [4]. The development of rural roads cannot be considered as one of the needs of the upper classes of roads and highways and even changes affecting the urban landscape. National highways are the first system to provide mobility and accessibility services [5].

State highways, main roads in the region and side roads have the task of mobility and accessing each other. The village roads basically play the role of access. For balanced and harmonious development of all classes of roads and all regions of the country, the construction of new rural roads and their improvement in areas with high communication is a priority [6, 7]. To assess success in road development programs, a small number of transportation indicators such as: road density, rural connectivity, traffic pattern, public transportation services, safety, government revenue, socio-economic benefits to collect and analyze Data analysis has been identified by various organizations that pay attention to rural development [8]. On the one hand, it is necessary to speed up the process of providing new road links for residential areas in situations that have low communication capability, and on the other hand, it is necessary to improve the current roads and roads in relatively better conditions. To directly meet economic as well as social development needs [9]. State highways, main roads in the region and side roads have the task of moving and accessing each other. The village roads basically play the role of access. For balanced and harmonious development of all classes of roads and all regions of the country, the construction of new rural roads and their improvement in areas with high communication is a priority [10,11]. To evaluate success in road development programs, a small number of transportation indicators such as: road density, rural connectivity, traffic pattern, public transportation services, safety, government revenue, socio-economic benefits for collection and analysis Data analysis has been identified by various organizations that pay attention to rural development [8]. On the one hand, it is necessary to speed up the process of providing new road links for residential areas in situations that have low connectivity. On the other hand, it is necessary to improve the current roads and roads in relatively better conditions in order to directly meet the economic and social development needs [9]. One of the most important differences between urban demand and rural demand is the difference in people's trip goals in these two regions. Every development program needs to evaluate its success through the measurement of objective

indicators, physical achievements, implementation levels, and the impact of the program on society [11, 12]. Such indicators and their periodic trends indicate whether the goals have been achieved as planned, whether the system is being implemented with the desired level of service, and whether the services that have been developed through development in the community have the intended impact. Or not? If the indicators are correctly identified, compiled and analyzed, it will help both in measuring and comparing performance at the level of external and internal economic sectors. Although in the normal period, physical achievements are generally measured, performance and efficiency, especially in rural roads, have not been much sought after. This requires a system that is properly identified and the resources allocated are expected. Transport indicators in rural roads cover a wide range of information [13,14].

In comprehensive urban transport and traffic studies, the entire area of the city is zoned and then by selecting a point as the center of the area, all the characteristics of the area are attributed to its center. Each area has a significant area, which is sometimes the size of a village or more, but in the village, due to the small area of the study area and the simplicity of the road network, it is not possible to zoning. The impossibility of zoning in the village means that the number of trips is not enough to obtain a coherent model for its demand [15].

Due to the short distance between each origin and destination of the trip in the village, most of the trips are done on foot or using cattle. Due to this point in the construction of demand models, trips are considered that are done with one of the types of vehicles and pedestrian trips are deducted from the total trips. There is no justification for developing a demand model within the village based on pedestrian travel. In fact, in the construction of demand models, each major factor in statistical information is the number of trips made by vehicles. In other words, the vehicle is the main factor in traffic and travel. Therefore, from this point of view, it is not possible to create a demand model for the village [16].

In the village, most trips are irregular due to the type of occupational context and structure of life, and unlike intra-city trips, which can be considered based on the purpose of the trip, the purpose of the trip is not clear, or change seasonally. For example, in winter, farmers do not make special trips between the house and the farmland. In addition, as described in section A, due to the small size of the village, it is not possible to separate the production and absorption points of the trip. Therefore, in this regard, the

construction of the demand model for the village is not justified [16]. Public transport has a very influential role in urban demand models [17], while this factor is ineffective in the village. Given the above and the fact that there are no traffic problems in the village and the main purpose of building a

demand model is to provide a solution based on demand results, building a demand model for the village is not justified and studies should be done to build demand models. In the inter-rural area. The following are some of the studies conducted in current study [16].

Table 1. Studies conducted in the current study

Study Title	Case Study	Methodology	Examined Parameters	Description
System Analysis to Create Low Traffic Roads (Gentlemen, 1997)	Astara	Methods used to evaluate projects: 1- Saving in the implementation of projects 2- Based on the distance between the projects 3- Conference analysis	- Population - Employment rate (non-farmer) - Number of farmers - Car ownership - Pickup truck ownership	One of the advantages of these methods is the simplicity of its implementation and one of their disadvantages is the lack of sufficient information in the available statistical sources or the invalidity of this information.
Rural Roads Maintenance Guidelines (Afandizadeh and Bigdeli Rad, 2023)	-	A- Indirect methods: 1) Using traffic factors 2) Based on the population and employment of the village B- Direct method: Using manual or automatic measurements, the traffic of each axis is obtained.	-	It is characterized by indirect methods, simplicity and speed in calculating it.
Urban Transportation Studies of Shahreza County (Parsab, 1997)		Field observations, interviews with informed people, questionnaires and statistics available in rural institutions and organizations	- Number of students - Motorcycle ownership - Population - Area of agricultural land	In this study, the sections of meteorology, physiography, hydrology, geology, erosion and sedimentation, social, economic, study of city roads, summarization and suggestions have been prepared.
Recognition of rural transportation and preliminary analysis of its supply and demand (Hajisoleimani, 2021)	Esfahan	Questionnaire, formation of database, single variable analysis of combined tables obtained from database, construction of travel production models for inside and outside the village by regression method.	- Number of farmers - Passenger ownership - pickup truck ownership - Population - Age of residents	The method of data collection is fully described. The process of conducting studies is quite similar to comprehensive urban transportation studies.
Coherent and integrated rural accessibility planning (Howe et al., 2019; Samanta, 2015)	Developing countries	Prioritizing the network of rural roads and very low capacity roads and highways, prioritizing rural infrastructure	-	It is a decision-making tool that includes many rural areas such as: health, water, health, education
Rural Development and Development Planning in India (Rao et al., 2003)	India	Rural Development which aims to develop Indian villages traffic by 2003	-	A comprehensive planning that examines the effects of construction and repair of roads on various parts of villages, etc., from transportation infrastructure to credit facilities as well as road maintenance.
Optimal rural road network design for developing countries (Montgomery et al., 2012)	India	Survey in the village with a certain number of families. Build the most optimal decision tree possible for all villages to connect using a computer program to calculate its cost and choose the tree decision that costs the least.	- Number of farmers - Car ownership - Pickup truck ownership - Average number of household children - Village area	It is useful for places where there is no suitable model for travel.

2. METHODOLOGY

Before introducing the rural road demand model, presenting the general modeling process and introducing its steps in the form of an algorithm, it seems necessary to structure the steps of this research. In this flowchart, the feasibility study is first

analyzed qualitatively and the scope of work for model construction is determined. After qualitative analysis of rural roads for modeling and selection of the approved area, the modeling steps are stated. [Figure 1](#) shows the general procedure of research.

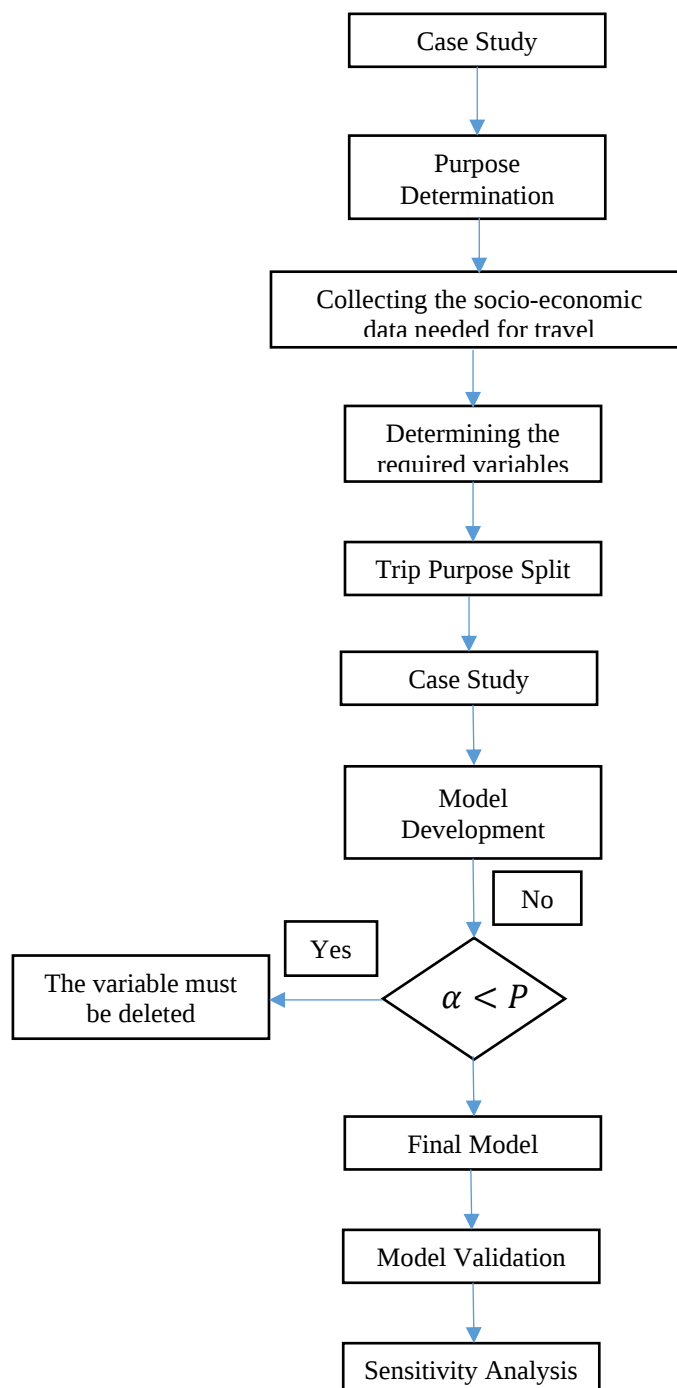


Figure 1. The current study method

In urban transportation planning, travel models are usually built in four stages. In the first stage, trip production and absorption models, in the second stage, trip distribution models, in the third stage,

vehicle mode choice models, and in the final stage, route selection and traffic assignment models. In this study, and according to the studies conducted on the difference in behavioral pattern as well as the

difference in the way of planning in the village and city, modeling related to the stage of production and absorption of travel is done using backward elimination regression.

2.1. Model used

When the number of independent variables (predictor) is high (eg population, distance, work, literacy, vehicle ownership, etc.), step-by-step regression methods are used, which are:

2.1.1. Step-by-step method

Step-by-step regression methods have been tested in various fields. The most common method is that none of the methods generally guarantee that the best regression model will be developed. The order of entry and exit of predictor variables into the model does not necessarily lead to the order of importance for predictor variables. A variable entered in the previous step may be worthless due to its relationship to the other variables in the model in the running step, and the information may be redundant. It should be noted that progressive selection, backward elimination, and step-by-step regression do not necessarily lead to the same final model. In this study, the backward elimination regression method is used for modeling, because one of the advantages of the backward elimination method is that in step zero, the effect of each of the independent variables according to the adjusted regression equation is seen [18].

Step-by-step regression methods are achieved by adding or subtracting a predictor variable from the regression model at a time according to their relative importance. Two important steps in step-by-step regression methods are:

- 1) Specify a criterion or criteria for selecting a model.
- 2) Define a strategy for applying selected criteria or criteria.

The criterion for adding or removing a predictor variable from the model can be expressed in terms of the sum the error least squares reduction, correlation coefficient, the F statistic, the T or P statistic [19].

backward elimination method

In the backward elimination method by working in the opposite direction, it is tried to get a good model, which means that it starts with a model that includes all the predictor variables. The backward elimination

method is often one of the best ways to select a variable, especially for analysts who want to see the impact of all the predictive variables involved [20].

The following steps are performed in the backward elimination method:

Step 1: Multiple regression model to include all the predictive variables available.

Step 2: Select the least important variable based on a predefined criterion; this is done by considering one variable at a time and treating that variable as the last variable that can enter the model.

Step 3: The significance of the selected variable is tested in step 2 and it is determined whether, based on the predetermined criteria, this variable can be removed from the model or not.

Step 4: Steps 2 and 3 are repeated for the variables that are still in the model. Following each step, if each variable is not compatible with the step 3 criterion, the further variable is not removed from the model and the process ends [21].

3. Case Study

Qazvin is one of the developed cities of Iran and the capital of Qazvin province. The city is located at an altitude of 1,278 meters above sea level. The area of this province is about 15,820 square kilometers and it neighbors the provinces of Mazandaran, Gilan, Hamedan, Zanzan, Markazi and Alborz. The population of Qazvin province, according to the statistics of 2016, is 1.3 million, of which 600,000 are residents of Qazvin. Now, in order to study more accurately, 24 villages have been selected on a case-by-case basis and the required information is collected (National Statistics Center of Iran website).

Then, after entering the information and in order to become more familiar with the transportation behavior as well as familiarity with the socio-economic behavior of the villagers and recognizing the influential variables in the demand for travel to a one-dimensional analysis of rural information including population, travel hours, goals of the trip, etc., are achieved. Table 2 shows the frequency of travel objectives of sample villages obtained from the Rural Affairs Office of Qazvin Governorate. As shown in the table, work trips account for the largest share of travel demand, and ethnic and medical trips account for a small percentage of trips.

Table 2. Travel information in the desired villages

Village Name	Population	Trip Purpose					Ownership (Per Household)			Working Population	
		Work	Educational	Ethnic	Medical	Shop	Motorcycle	Car	Pickup Truck	Farmer	Non-Farmer
Ardabilak	801	354	196	79	71	96	0.65	0.072	0.056	122	561
Nezam Abad	4676	1021	401	171	179	184	1.22	0.24	0.11	852	3021
AltinKosh	973	402	169	62	63	71	0.72	0.077	0.065	136	610
Esmail Abad	2159	860	321	98	92	102	0.84	0.12	0.078	382	1547
Aloolak	819	311	121	48	50	53	0.67	0.07	0.05	152	523
Aghababa	3000	925	365	117	102	126	1.09	0.17	0.08	621	1845
Jannat Abad	259	104	36	19	18	20	0.29	0.031	0.039	79	136
Hasan Abad	654	248	72	21	22	24	0.58	0.06	0.043	165	429
Charis	790	295	121	41	43	52	0.7	0.072	0.055	130	551
Hosein Abad	944	301	139	52	48	61	0.69	0.079	0.062	168	631
Parchkooh	300	146	82	33	29	39	0.31	0.033	0.036	94	185
Hamid Abad	799	326	133	56	57	61	0.73	0.068	0.052	141	526
Khakineh	392	235	142	50	55	63	0.32	0.036	0.026	94	246
Kheir Abad	1126	396	193	81	85	92	0.84	0.1	0.07	264	721
Zakan	351	198	101	46	48	52	0.31	0.032	0.024	88	211
Zar Abad	342	168	91	40	41	45	0.34	0.041	0.031	91	216
Soltan Abad	195	91	43	18	19	20	0.21	0.033	0.025	54	112
Sonjanak	511	369	164	77	71	81	0.42	0.049	0.042	132	325
Sefidab	483	225	103	44	40	50	0.45	0.046	0.039	125	312
Shafie Abad	485	260	135	54	49	63	0.42	0.05	0.048	136	301
Farsian	3285	984	425	189	172	215	1.15	0.2	0.82	620	2201
Kooshk	397	279	108	52	55	57	0.38	0.045	0.043	99	269
Naser Abad	2748	483	249	99	102	119	1.14	0.19	0.086	545	1952
Najaf Abad	1348	503	269	115	121	131	0.86	0.13	0.078	195	921

[Table 2](#) also shows that the dominant modes for the villagers, which are owned by the residents, are Motorcycles, cars and pickup track. Motorcycle ownership is about three times that of cars and pickup tracks, while most village-to-city trips are by bus, minibus, and passenger car, and the most common use of Motorcycles is within the village or maximum from village to village. Given that the transportation system as well as vehicle ownership in rural areas is not cohesive enough, so there is no choice in the vehicle and the separation is practically meaningless. In addition, according to [Table 2](#), the majority of work and educational trips are by public transport,

such as minibuses and buses, so instead of a separate model for the village, it is better to increase the public transport system. And based on this share, the public transportation system required for the village to the city should be designed.

This design includes the use of common public transportation systems in the country such as buses, minibuses, pickup tracks and taxis, and it is necessary to set a schedule for each of these systems to reduce waiting time and travel time in general, as well as to meet demand. It is peak and non-peak hours.

3. RESULTS AND DISCUSSION

In this study, the backward elimination method is used for modeling, because one of the advantages of the backward elimination method is that in step zero, the effect of each of the independent variables is seen according to the adjusted regression equation.

3.1. Model Development

According to the explanations and methods described in the previous section, in this section, travel demand models are made according to the available data. In this study, the backward elimination method is used to develop the model.

3.1.1. The relationship between work trip demand and independent variables

Using the regression method of backward elimination, variables affecting work trip demand are identified. The dependent variable is work trip demand. The independent variables studied (based on repetition in previous studies) are:

X_1 : Population X_2 : Employment Rate (Non-Farmer) X_3 : Farmer Rate

X_4 : Number of Students X_5 : Motor Ownership (per household)

X_6 : Passenger Ownership X_7 : Property of the Pickup Track (Per Household)

Using the backward elimination method, considering the removal α coefficient equal to 0.1, the relationship between work trip demand and independent variables was investigated. According to the backward elimination regression algorithm, the effect of all independent variables is examined in step zero. In step 1, the variable number of students had the highest P-value and was removed from the model [21]. In steps 2 to 4, the variables of pickup track ownership, car ownership, and farmer rate were removed from the model, respectively. In the next step (step 5), no variable had the conditions of removal from the model, in other words, the other independent variables remaining in the model had a significant effect on work trip demand. The backward elimination regression algorithm ends with the presentation of the final model (1).

$$y_1 = 248.52 + 2.354 x_1 + 2869.21 x_2 + 224.68 x_6 \quad (1)$$

3.1.2. The relationship between educational travel demand and independent variables

In examining the relationship between the demand for educational travel and independent variables, the

backward elimination regression method using 0.1 α elimination will be used. According to the backward elimination regression algorithm, the effect of all independent variables is examined in step zero. In step 1, the employment rate variable had the highest P-value and was removed from the model. In steps 2 to 4, the variables of motor ownership, pickup track ownership, and the rate of being a farmer were excluded from the model, respectively. In the next step (step 5) there were no conditions for removal from the model, in other words, the other independent variables remaining in the model had a significant effect on the demand for academic travel. The backward elimination regression algorithm ends with the presentation of the final model (2).

$$y_2 = 309.265 + 2.487 x_1 + 293.258 x_4 + 86.35 x_6 \quad (2)$$

3.1.3. The relationship between travel demand and independent variables

Using the backward elimination method, considering the removal coefficient α equal to 0.1, the relationship between shopping travel demand and independent variables was investigated. According to the backward elimination algorithm, we see that in step zero, the effect of all independent variables is investigated. In step 1, the number of students varied had the highest P-value and was removed from the model. In steps 2 to 4, the variables of motorcycle ownership, pickup track ownership, number of students, and passenger ownership were excluded from the model, respectively. In the next step (step 5), no variable had the conditions of removal from the model, in other words, the other independent variables remaining in the model had a significant effect on the travel demand. The backward elimination regression algorithm ends with the presentation of the final model (3).

$$y_3 = 83/225 + 1/01 x_1 + 214/25 x_2 + 165/216 x_3 \quad (3)$$

3.1.4. The relationship between ethnic's travel demand and independent variables

In examining the relationship between ethnic's travel demand and independent variables, the sonic regression method will be used, taking into account the elimination α of 0.1. According to the backward elimination regression algorithm, it is observed that in step zero, the effect of all independent variables has been investigated. In step 1, the variable rate of being a farmer had the highest P-value and was

removed from the model. In steps 2 to 4, the variables of pickup track ownership, engine ownership, and number of students were excluded from the model, respectively. In the next step (step 5), no variable had the conditions of removal from the model, in other words, the other independent variables remaining in the model had a significant effect on the travel demand of the relatives. The backward elimination algorithm ends with the presentation of the final model (4).

$$y_4 = 19.65 + 1/986 x_1 + 267.219 x_2 + 15.268 x_6 \quad (4)$$

3.1.5. The relationship between medical travel demand and independent variables

Using the backward elimination method, considering the α removal coefficient α equal to 0.1, the relationship between medical travel demand and independent variables was investigated. In step 1, the variable rate of being a farmer had the highest P-value and was removed from the model. In steps 2 to 4, the employment rate variables, the number of students, and the ownership of the engine were excluded from the model, respectively. In the next step (step 5), no variable had the conditions of removal from the model, in other words, the other independent variables remaining in the model had a significant effect on the demand for medical travel. The algorithm ends with the presentation of the final model (5).

$$y_5 = 2.965 + 0/818 x_2 + 55.265 x_6 + 26.354 x_7 \quad (5)$$

3.1.6. The relationship between total travel demand and independent variables

In the study of the relationship between total travel demand and independent variables, the regression method of backward elimination with 0.1 elimination

α will be used. According to the backward elimination algorithm, the effect of all independent variables has been investigated in step zero. In step 1, the employment rate variable had the highest P-value and was removed from the model. In step 2, the ownership variable with the highest p value was removed from the model. In the next step (step 3), no variable had the conditions of removal from the model, in other words, the other independent variables remaining in the model had a significant effect on total travel demand. The backward elimination algorithm ends with the presentation of the final model (6).

$$y = 965.236 + 1.306 x_1 + 995/657 x_3 + 2.681 x_4 + 568.957 x_6 + 368.459 x_7 \quad (6)$$

3.2. Sensitivity Analysis

In this section, it is determined which variable is more effective than the other variables compared to other variables. For this purpose, non-standard coefficients are formed for each model table, which can be obtained by using the absolute value of the obtained coefficients. These cases were obtained.

[Table 3](#) shows the non-standardized and standardized coefficients for work trip demand. It can be seen that the variables in the final model have a positive (incremental) effect. T-value values greater than 1.96 or P-values less than 0.05 indicate that the values are validated and within the allowable range. On the other hand, the standardized coefficient column shows that the employment rate variable ($\beta = 0.501$) has the greatest effect among the available variables. In other words, 60% of the model is influenced by the employment rate variable. The ownership variable, with 14%, has the least impact on the model.

Table 3. The estimated regression coefficients in the final model for work trip demand.

P	T	Standardized Coefficient	Unstandardized Coefficient		Work Trip Demand Variables
			Standard Error	Coefficient	
<0.003	2.21		65.35	248.52	Constant
0.016	2.45	0.216	0.524	2.354	Population
<0.002	4.21	0.501	995.36	2869.21	Employment Rate
0.031	1.99	0.115	164.27	224.68	Car Ownership

The values of the coefficients of the variables are given in [Table 4](#). It can be seen that the variables in the final model have a positive (incremental) effect.

Standardized coefficients indicate that the student number variable ($\beta = 0.489$) has the greatest effect among the available variables. In other words, 52%

of the model is influenced by the number of students.
The 21% car ownership variable has the least impact on the model.

Table 4. The regression coefficient table estimated in the final model for the educational trip

P	T	Standardized Coefficient	Unstandardized Coefficient		Educational Trip Demand Variables
			Standard Error	Coefficient	
<0.001	4.65		79.356	309.265	Constant
0.016	2.69	0.252	1.12	2.487	Population
0.047	1.98	0.489	76.32	152.365	Number of university students
<0.001	4.26	0.192	58.69	86.35	Car Ownership

[Table 5](#) shows the non-standardized and standardized coefficients for the shopping travel demand. The standardized coefficients column shows that the population variable ($\beta = 0.615$) has the greatest effect among the available variables. In other words, 54%

of the model is affected by the population variable. The variable rate of being a farmer with 22% has the least effect on the model. T-value values are higher than 1.96 and P-value is less than 0.05 and is within the allowable range.

Table 5. The regression coefficient table estimated in the final model for shopping travel demand

P	T	Standardized Coefficient	Unstandardized Coefficient		Shopping Travel Demand Variables
			Standard Error	Coefficient	
0.032	2.39		21.265	83.225	Constant
<0/001	4.92	0.615	0.058	1.01	Population
0.015	2.65	0.289	65.36	214.25	Employment Rate
0.044	1.97	0.247	89.401	265.216	Farmer Rate

The estimated regression coefficients in the final model for ethics travel demand are shown in [Table 6](#). It can be seen that the population variables and employment rate in the final model have a positive effect, but the ownership variable has a negative effect. The standardized coefficients column shows

that the population variable ($\beta = 0.416$) has the greatest effect among the available variables. In other words, 49% of the model is influenced by the population variable. The ownership variable, with 16 percent, has the least impact on the model.

Table 6. Estimated regression coefficient table in the final model for ethnic travel demand

P	T	Standardized Coefficient	Unstandardized Coefficient		Ethnic Trip Demand Variables
			Standard Error	Coefficient	
0.021	2.35		4.69	19.65	Constant
<0/001	4.66	0.416	0.24	1.986	Population
0.012	2.61	0.301	59.68	267.219	Employment Rate
0.148	2.06-	-0.137	3.12	-15.268	Car Ownership

According to [Table 7](#), the variables of passenger car ownership and pickup truck ownership in the final model have an increasing effect. The standardized coefficients column shows that the employment rate variable ($\beta = 0.21$) has the greatest effect among the available variables. In other words, 28% of the model

is affected by the employment rate variable. The 19% ownership of the pickup truck has the least impact on the model. T-value values in the employment rate variable are less than 1.96 and P-value is more than 0.05 and are not allowed in the range.

Table 7. The regression coefficient table estimated in the final model for medical travel demand.

P	T	Standardized Coefficient	Unstandardized Coefficient		Medical Trip Demand Variables
			Standard Error	Coefficient	
0.032	2.65		0.89	2.965	Constant
0.221	2.79-	-0.21	0.015	-0.818	Employment Rate
0.039	1.99	0.4	19.58	55.265	Car Ownership
0.016	2.24	0.14	11.26	26.354	pickup truck

The non-standardized and standardized coefficients for total travel demand are shown in [Table 8](#). It can be seen that the variables in the final model have a positive (incremental) effect. To compare the effects of the independent variables in the final model on total travel demand, we use standardized regression coefficients. The standardized coefficients column

shows that the population variables ($\beta = 0.384$) and the number of students ($\beta = 0.294$) have the greatest effect among the available variables. In other words, 29% of the model is influenced by population variables. The 7% pickup truck ownership variable has the least impact on the model.

Table 8. The regression coefficient table estimated in the final model for total travel demand

P	T	Standardized Coefficient	Unstandardized Coefficient		Total Travel Demand Variables
			Standard Error	Coefficient	
<0.001	4.68		204.36	965.236	Constant
0.047	2.21	0.384	0.096	1.306	Population
0.004	3.41	0.294	0.406	2.681	Number of University Students
0.024	2.67	0.141	224.69	995.657	Former Rate
0.006	2.94	0.094	192.64	568.957	Car Ownership
0.029	2.01	0.074	174.79	368.459	Pickup Truck Ownership

3.3. Modeling Results

In the previous section, travel demand models were created according to the available data and explained in detail, as well as the sensitivity analysis of the

models was analyzed. In the following [Table 9](#), a summary of the results obtained in the construction of the models is shown.

Table 9. Summary of the results obtained in the construction of the models.

Influential Variable	R ²	Significance	Developed Model	Travel Purpose
Employment Rate	0.92	Yes	$y_1 = 248.52 + 2.354 x_1 + 2869.21 x_2 + 224.68 x_6$	Work
Number of University Students	0.845	Yes	$Y_2 = 309.265 + 2.487 X_1 + 293.258 X_4 + 86.35 X_6$	Educational

Population	0.831	Yes	$y_3 = 83.225 + 1.01 x_1 + 214/25 x_2 + 165/216 x_3$	Shop
-	0.789	No	$y_4 = 19.65 + 1.986 x_1 + 267.219 x_2 - 15.268 x_6$	Ethnic
-	0.761	No	$y_5 = 2.965 - 0.818 x_2 + 55.265 x_6 + 26.354 x_7$	Medical
Population	0.94	Yes	$y = 965.236 + 1.306 x_1 + 995.657 x_3 + 2.681 x_4 + 568.957 x_6 + 368.459 x_7$	Total

3.4. Discussion

Based on the model provided for the purpose of the work trip, it was observed that the parameters of population, employment rate and ownership were influential. From a theoretical point of view, the model also indicates that due to the regularity of work trips, it is possible to consider stable and regular behavior for these trips, which depend on certain variables. Logically, career trips can be related to things like employment rates, population, and so on. On the other hand, the value of R-Sq obtained for this purpose of travel is about 0.92, which indicates that the model is linear with a relatively high and acceptable approximation. In other words, the model presented is well fitted to the actual information.

In the model of educational trips, population parameters, number of students and passenger ownership with a positive coefficient are known as effective parameters. Like the previous model, educational trips are regular trips and logically, parameters such as population, number of students, etc., are among the influential parameters in educational trips. On the other hand, the R-Sq for this model is about 0.845, which is open. The model indicates the fit of the model to the information provided for the model, and other parameters have been eliminated step by step based on the backward elimination method, which proves the ineffectiveness of these parameters in the model.

Travel with the purpose of buying and selling, to some extent, has less order than work trip and educational trip, however, based on the model provided for this purpose of travel, it was found that in rural areas, after work and educational trip, travel with the purpose of shopping and Sales have a special order and are considered as important trips, the reason for which can be attributed to the sale of agricultural products, etc. The amount of R-Sq for this model is about 0.831, although it is less than the previous two models. But it still has a good fit on the data.

For each ethnic and medical trip, a separate model was considered, which was not valid due to the inverse relationship between passenger ownership variables and employment rates, and the T-value was less than 1.96 and the P-value was higher than 0.05 is not a valid model.

3.4.1. Validation of models together

According to the results of the previous section, models with the purpose of work, educational and sales travel are valid, and on the other hand, the model with the aim of traveling ethics and medicine is not significant and has no validity. On the other hand, according to the information provided for travel purposes, it is observed that career trips are about 30 to 40 percent, educational trips are about 25 percent, and shopping trips are about 25 percent of all trips, and 10 to 20 percent. The remaining percentage is made up of family and medical visits. So at worst, 80 percent of all trips have a valid model, and the remaining 20 percent lack a meaningful model, which can be justified by a good approximation that these demand models are responsive. At the same time, it is important to note that ethnic and medical trips are not regular trips and are generally included in the general demand model. In other words, it is logical not to justify the model for these trips due to lack of clear order in time and volume.

3.4.2. Validation of the travel demand model

This model, which actually consists of trips with different purposes mentioned in the previous two sections, also has justification and validity. One initial justification for this model is the validity of 80% of total trips in separate models for travel purposes. However, based on the analyzes performed on all variables to build a single model for all trips with different travel goals, population variable, number of students, farmer rate, passenger ownership and ownership of pickup tracks with positive coefficients, it affects the model and the resulting model. With 94%-Sq =, it fits the data well.

4. CONCLUSION

In classifying the country's roads, rural roads basically play the role of access. Due to the multiplicity of these roads and their key role in increasing accessibility in different areas, first through various criteria such as traffic pattern, road density, safety, etc., the importance of each of these ways can be determined. Then, according to the existing budget, they are built or optimized. Therefore, knowing the number of trips and, if possible, having a model for travel demand will help you to know more about future decisions about these routes. In the interior of the village, due to the small area of the study area and the simplicity of the road network, it is not possible to zoning, i.e. the number of trips is not enough to obtain a coherent model for its demand. Inside the village, most trips are irregular due to the type of occupational context and structure of life, and unlike city trips, which can be considered as a purpose based on the purpose of the trip, the purpose of the trip is not clear, or Seasonal changes. For example, during the winter, farmers do not make special trips between the house and the farmland. The difference in the type of supply in the villages and the city and the difference in facilities between them is the main reason for these trips from the village to the city. In the rural-urban communication routes, travel has a relatively high number and order because there are travel attractions in the city. This creates travel for different purposes to these places. The most

important goals of villagers 'travels to the city are work trips, medical trips, educational trips, shopping trips and relatives' trips. Among the mentioned trips, work and educational trips are the most frequent trips, which are done with more order. Motorcycles are also the predominant fashion for villagers owned by residents. Motorcycles are commonly used for trips within the village or at most from village to village. According to the constructed models, it was found that in work trips, the variable rate of employment, in educational trips, the number of students, in shopping trips, ethnicity and medicine, and in the demand for total travel, the population variable has the greatest impact on the model. With the current situation demand, it is possible to develop a demand forecast model for different horizons by applying the population growth rate and employment. By estimating the demand for travel, in order to create and build road and rural facilities, road pavement and road maintenance can be planned. The study was conducted for villages with a population of more than 100 households, a rural center or similar, with a similar climate, a significant number of trips, and a somewhat regular population. The results of this study will be useful and necessary for planning to improve the access and living conditions of these villages and other villages that have such characteristics.

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